Construction Clearance at Fort Dix Range 65 Using Two Different Methodologies

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Abstract

To accommodate renovation of Range 65 at Fort Dix, New Jersey, a clearance prior to construction was planned in the summer of 1997. A clearance operation using standard handheld magnetometers was selected by the U.S. Army Engineering and Support Center, Huntsville, and its contractor, to clear the footprint of construction areas. Clearance began in the fall of 1997. Clearance depths ranged from 1.5 feet to 7 feet, in accordance with construction plans. The clearance effort that occurred from September 1997 until December 1997 was slowed after the contractor encountered an extremely large density of unexploded ordnance (UXO), ordnance scrap, and other non-ordnance scrap. After three months of field effort (the estimated contract period), over one-half of the work remained to be done.

Due to the high cost and slow progress of clearing the range area, alternative methods were evaluated. At this point, detection technology using geophysical mapping techniques was improving to the extent that the Huntsville Center geophysical team believed the project could successfully be completed by mapping the remaining areas and identifying anomalies which were likely ordnance or ordnance scrap. The objective of the mapping effort was to minimize the cost of clearance by reducing the number of digs.

The geophysical mapping was completed and anomalies selected for investigation by the clearance team. The remaining areas were cleared and one area previously cleared using "mag and flag" methodology was also mapped. Excavations decreased to about 1/6 of the previous rate. Since non-ordnance scrap was no longer being exposed, the total recovered scrap decreased by 90%. Thirteen inert ordnance items were discovered as a result of the geophysical mapping that were not detected during the mag and flag operation. The cost to complete the last one-half of the area using geophysical mapping technology was less than $7,000 per acre whereas the cost of the clearance of the first half using mag and flag methodology was over $30,000 per acre. Field time also proportionately decreased during the second phase.

Background

In 1997, Range 65 at Fort Dix, NJ, was an inactive range. As a result of the Base Realignment and Closure (BRAC) process, it was determined that the range would be updated for use by the

New Jersey National Guard. The renovation or updating of the range was managed by the U.S. Army's Department of Public Works (DPW) at Fort Dix. The U.S. Army Corps of Engineers, New York District, designed the range renovation and awarded the construction contract.

Safety during the construction was acknowledged as a critical factor, and the Fort Dix DPW agreed to provide a clearance for the construction area. A surface clearance was performed by the Army's active duty Explosive Ordnance Disposal (EOD) team stationed at Fort Dix. However, because of other mission requirements, the EOD team could not dedicate the personnel to perform a subsurface clearance, and the U.S. Army Engineering and Support Center, Huntsville, was contacted to provide a subsurface clearance over 25 acres of the range in which excavation by the construction contractor would occur. Construction depths ranged from 18 inches to 7 feet. The 25 acres included locations for new target installation, utility upgrades, and a 7-acre borrow area.

The availability of funds and compressed schedule for the subsurface clearance were factors that weighed heavily in the project planning process. Because of the limited funding and the impact on the construction schedule, no sampling was done to determine the density of ordnance and explosives within the 25 acres. Instead, an estimate of the density, which determined the estimated production rates during clearance, was made based on conditions at similar ranges. This estimate was used to award the subsurface clearance contract on a time-and-materials basis.

First Phase

At the time the subsurface clearance project was initiated, clearance using hand-held magnetometers, commonly called "magging and flagging," was the best available technological option for heavily contaminated areas such as Range 65. Thus, the approved work plan specified their use and work proceeded in September 1997.

Once the contractor mobilized and began subsurface clearance, the actual production rates were much less than originally estimated, due to the excessive number of digs that had to be made to clear the anomalies. Within two months, it was agreed that the current approach was not successful and changes to the clearance methodology were required. The extremely high metallic density under the surface of the ground made it very difficult to detect every ordnance or ordnance-like item. Both quality control and quality assurance checks identified additional items that had been overlooked in the initial sweep. The rework that was required due to QC and QA failures and the slow production rates expended the contract funds. After three months, most contract funds were expended and the subsurface clearance was only one-half complete.

At this point, the project team learned of recent successful results using digital geophysical mapping technology to identify/detect ordnance or ordnance-like objects. Huntsville Center's engineering team determined that, in spite of the high metallic density at Fort Dix, the digital geophysical mapping technology could be expected to perform well at this site for a subsurface clearance.

Second Phase

After a holiday and winter break, work resumed in April 1998 using a digital geophysical mapping process to identify possible ordnance items, instead of using audio-based hand-held magnetometers, as was originally done. When digital geophysical mapping began, 13.3 acres, including 6.9 acres of the 7-acre borrow pit, had been cleared using mag and flag technology (the first phase effort). In this second phase, the remaining 11.8 acres were digitally mapped using geophysical equipment, plus 6.9-acres of the borrow pit previously cleared during the first phase were also digitally mapped. The entire process of digital geophysical mapping, analysis, re-acquisition of anomalies, investigations, and recovery/disposition of items over the 18.7 acres took only about a month to complete. The contractor demobilized in mid-May 1998.

A comparison of statistics was made after the work completed. In the first phase of the work, which was completed using hand-held magnetometers, 70,241 excavations were made to clear anomalies. A total of 131 unexploded ordnance items were recovered and disposed and 707 inert ordnance items, or practice rounds, were recovered. Over 11,000 pounds of non-ordnance scrap was recovered. The contractor spent 8,935 man-hours completing the first work phase at a cost of $34,050 per acre for the 13.3 acres cleared.

During the second phase, using digital geophysical mapping, 12,280 excavations were made to clear anomalies. A total of 14 unexploded ordnance items and 259 inert items were recovered. Only 1,126 pounds of non-ordnance scrap was recovered. The contractor expended only 1,619 man-hours during the second phase, at a total cost, including the digital geophysical mapping, of only $6,283 for the 18.7 acres cleared. These statistics included clearance of 6.9 acres previously cleared during mag and flag operations.

The number of ordnance and explosives items recovered were compared on a “per acre” basis. Using hand-held magnetometers only, the recovery rate ranged from 7 to 89 items per acre, depending on the location of specific parcels. Using digital geophysical mapping, the recovery rate ranged from 2 to 51 items per acre. It should be noted that the borrow area included, by far, the highest density of ordnance and explosives items. In fact, over 73% of the total items recovered during mag and flag operations were found in this one area. The statistics do show that, of the two technologies, magging and flagging recovered more ordnance and explosives items than geophysical mapping. This is believed to be attributable to the fact that the borrow area was done first using that technology. Had the borrow area been geophysically mapped and analyzed before being magged and flagged, it is likely that the mapping method would have produced the most ordnance and explosives items. This conclusion is based on the fact that the most commonly occurring item was the 60mm practice rounds, and large quantities of this item were identified by both technologies.

Conclusions

Several lessons or interesting facts emerged as a result of using both technologies at this site.

- During the digital geophysical mapping phase, the unexploded ordnance contractor completed digs faster than re-acquisitions could be made.

- Thirteen inert items were located during geophysical mapping in areas previously cleared during mag and flag operations at depths ranging from 0-18 inches.

- Mag and flag methodology recovered ordnance and explosives items ranging from 20mm to 106mm.

- Geophysical mapping methodology recovered ordnance and explosives items ranging from 60mm to 105mm. The fact that no 20mm items were found is not surprising, since only a total of 8 were found during the mag and flag search.

Post Clearance

Construction of the range renovation is now complete. No accidents due to ordnance were reported. During the period May 1998 through February 1999, the Fort Dix EOD unit responded to 12 requests from the construction team to investigate possible ordnance items. A total of 25 items were recovered and disposed; approximately 9 were inert and 16 were UXO items. It is not known exactly where these items were found and it is possible that some were not within the 25 acres cleared. General construction activities such as heavy equipment passes and wheel turns can sometimes uncover ordnance that lies just under the ground's surface. It is common for additional ordnance items to appear during construction, even though a clearance has been performed. For that reason, a UXO contractor is normally employed to assist during the construction process. The presence of an active duty EOD unit at Fort Dix eliminated this requirement.

Summary

The use of digital geophysical mapping at this site appears to have been successful from a quality and performance standpoint. The cost reduction using digital geophysical mapping methodology versus magging and flagging was extremely significant in this case. The results can be used to assess technological approaches for similar situations.

Biography

Carol A. Youkey is a Project Manager assigned to the Ordnance and Explosives Team's Center of Expertise at the U.S. Army Engineering and Support Center, Huntsville. She is a registered Professional Engineer and Land Surveyor in the State of Alabama and has worked with the Ordnance and Explosives Directorate since November 1995.